3 Literature Review

3.1 Scope Statement

"Review existing documentation with regard to SCC history, research conducted to understand the mechanisms causing or contributing to SCC, and prevention, detection and mitigation of SCC."

3.2 Literature Search and Database

A literature search of technical papers, reports, and articles discussing SCC in pipelines was conducted in an attempt to identify the most current and informative documents about understanding and managing SCC. The complete results of the literature review were included in an SCC literature database. This Microsoft Access® database was compiled using a database developed for the OPS from 1998-1999 by General Physics (Hall and McMahon 1999). A few of the reports considered most informative for understanding and managing SCC are discussed in Section 3.3.

A description of the complete database system containing over 300 references is presented in Section 3.4.

3.3 Recommended References

The majority of documentation available focuses on understanding the mechanisms of SCC and conditions conducive to SCC, and is of interest for researchers and others wanting to understand the science of SCC. However, there are a few papers that provide a useful comprehensive overview of understanding and managing SCC, and are valuable for the operator, regulator, and others interested in developing a more general knowledge of SCC.

Perhaps the best of these reports is the *Report of the Inquiry* [on] *Stress Corrosion Cracking on Canadian Oil and Gas Pipelines* by the Canadian National Energy Board (NEB 1996). Composed in 1996, this report is not the most recent; however it is a well-written, readable, and comprehensive piece. Because it specifically addresses issues on Canadian pipelines, the first two chapters are only applicable to this study. While the main focus is on near-neutral-pH SCC, the predominate type experienced in Canada, high-pH SCC is addressed adequately, making this document a very good basic reference, and one that anyone interested in understanding and managing SCC should read.

Another helpful reference is *Stress Corrosion Cracking–Recommended Practices* published by the Canadian Energy Pipeline Association (CEPA 1997a). An effort to revise and update the document is currently underway. This is possibly the only publicly available document that presents "practices" to help operators manage longitudinal, near neutral-pH SCC. While being specifically written to address near neutral-pH SCC, the document is still applicable to all types of pipeline SCC. The document presents an excellent model for pipeline operators who are setting up procedures for preventing, controlling and mitigating external SCC.

CEPA produced an additional report that specifically addresses circumferential SCC, a less common form of SCC (CEPA 1997b). This report documents the experiences of NOVA Gas Transmission

Ltd., Northwestern Limited, Federated Pipe Lines Ltd., and the SNAM system in Italy in investigating and mitigating leaks due to circumferential SCC. Subsequently, CEPA issued an addendum to the *Stress Corrosion Cracking—Recommended Practices* addressing circumferential SCC (CEPA 1998). Circumferential SCC occurs when axial or longitudinal stress, not hoop stress, is the major stress component and is typically associated with ground movement. Circumferential SCC can be classified as either near neutral- or high-pH SCC.

In their report, *Protocol to Prioritize Sites for High pH Stress-Corrosion Cracking on Gas Pipelines*, Eiber and Leis (1998) document the development of a simple form for evaluating the susceptibility of a pipeline segment to high-pH SCC. An example of an SCC integrity management plan is also presented. This document provides detailed descriptions of the variables considered to be vital when determining the degree of susceptibility of a pipeline to high-pH SCC and presents summary level supporting historical data. On the whole, this paper is easy to read and presents good information for use in assessing and managing high-pH SCC.

Another good reference is the recently released NACE International Publication 35103, *External Stress Corrosion Cracking in Underground Pipelines* (NACE 2003). This document contains much of the same information as the NEB report, MH-2-95 (NEB 1996), but also incorporates information learned in the last few years.

3.4 Database Description

The SCC Microsoft Access® database contains basic bibliographic information for over 300 documents, as well as a brief abstract and a number of associated keywords for each report to facilitate searches of the data. Searches can also be performed on the other information contained in the database. Upon entry to the database, the menu shown in Figure 3-1 is displayed, allowing either a general review of the information contained on the database, or the available search options for more specific information.

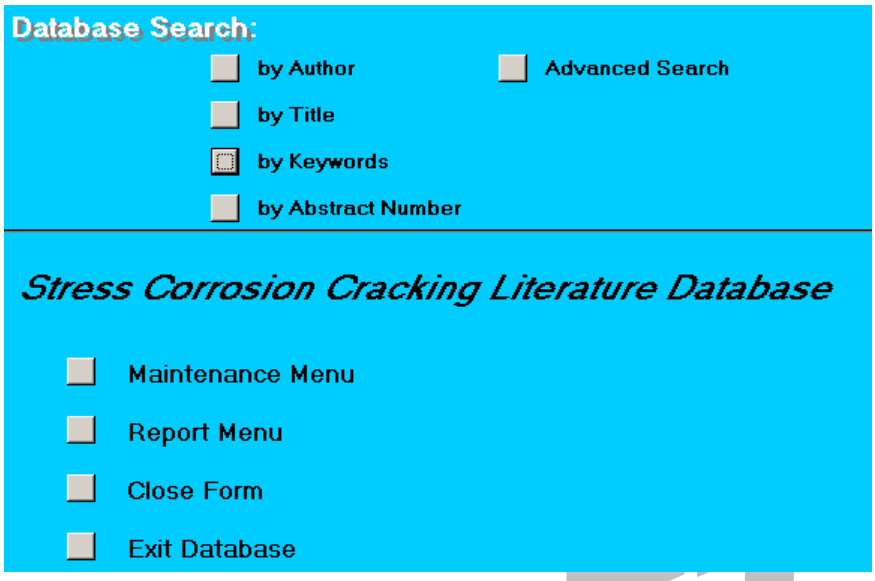
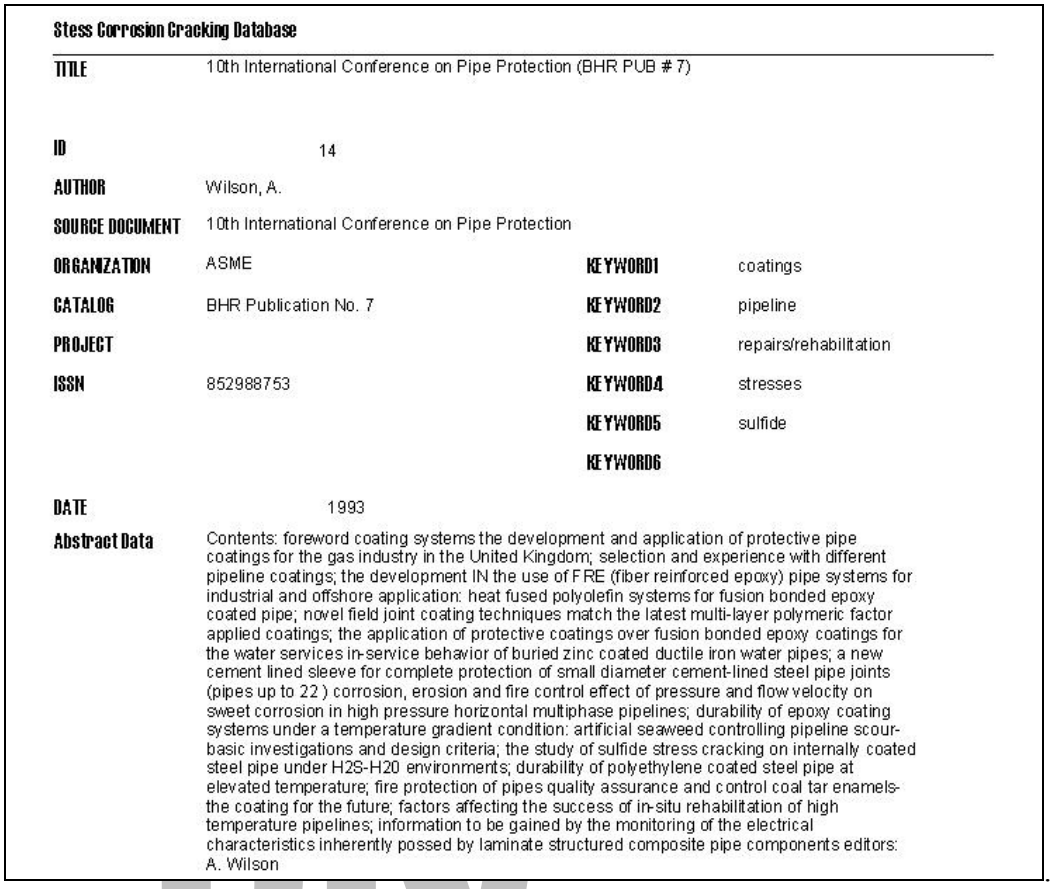


Figure 3-1 Entry Menu to Database

A typical report is displayed in Figure 3-2. The database is not locked, so users can perform their own updates, edits, commenting as desired through a maintenance system, with the menu shown in Figure 3-3.



Stess Corrosion Cracking Database

TITLE	10th International Conference on Pipe Protection (BHR PUB # 7)		
ID	14		
AUTHOR	Wilson, A.		
SOURCE DOCUMENT	10th International Conference on Pipe Protection		
ORGANIZATION	ASME	**KEYWORD1**	coatings
CATALOG	BHR Publication No. 7	**KEYWORD2**	pipeline
PROJECT		**KEYWORD3**	repairs/rehabilitation
ISSN	852988753	**KEYWORD4**	stresses
		KEYWORD5	sulfide
		KEYWORD6	
DATE	1993		

Abstract Data

Contents: foreword coating systems the development and application of protective pipe coatings for the gas industry in the United Kingdom; selection and experience with different pipeline coatings; the development IN the use of FRE (fiber reinforced epoxy) pipe systems for industrial and offshore application: heat fused polyolefin systems for fusion bonded epoxy coated pipe; novel field joint coating techniques match the latest multi-layer polymeric factor applied coatings; the application of protective coatings over fusion bonded epoxy coatings for the water services in-service behavior of buried zinc coated ductile iron water pipes; a new cement lined sleeve for complete protection of small diameter cement-lined steel pipe joints (pipes up to 22) corrosion, erosion and fire control effect of pressure and flow velocity on sweet corrosion in high pressure horizontal multiphase pipelines; durability of epoxy coating systems under a temperature gradient condition: artificial seaweed controlling pipeline scour-basic investigations and design criteria; the study of sulfide stress cracking on internally coated steel pipe under H2S-H20 environments; durability of polyethylene coated steel pipe at elevated temperature; fire protection of pipes quality assurance and control coal tar enamels-the coating for the future; factors affecting the success of in-situ rehabilitation of high temperature pipelines; information to be gained by the monitoring of the electrical characteristics inherently possed by laminate structured composite pipe components editors: A. Wilson

Figure 3-2 Typical Document Report from Database

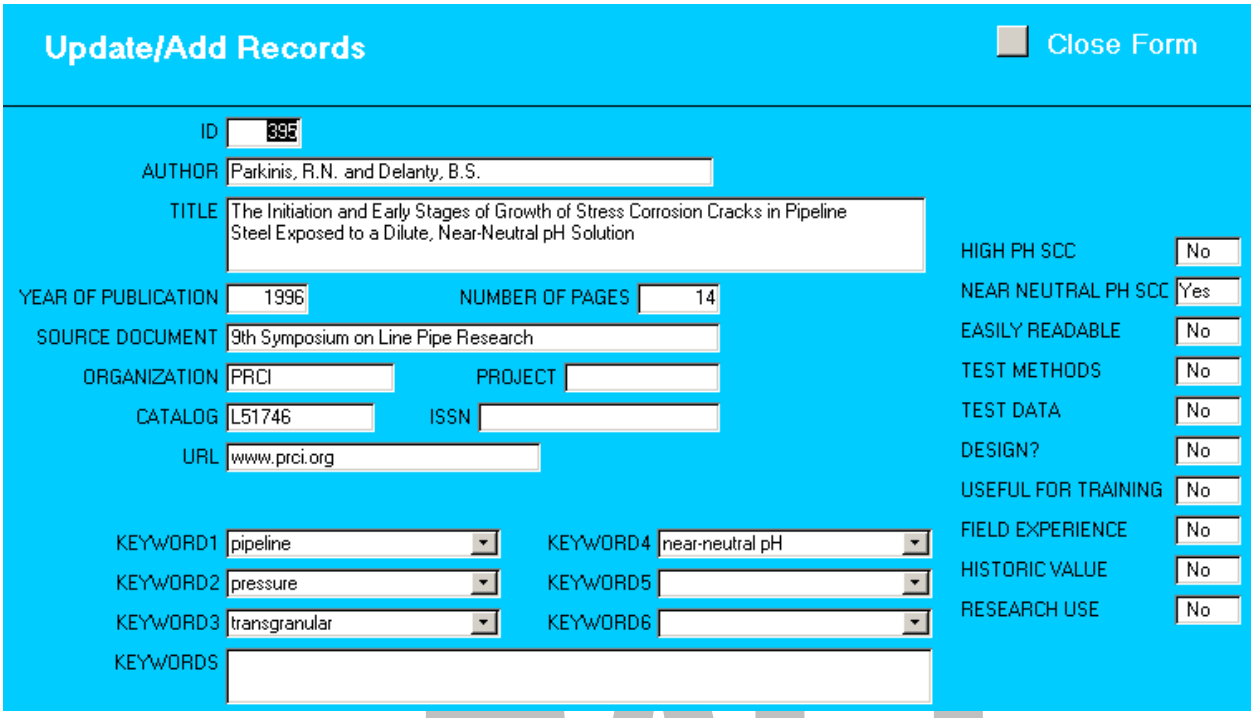


Figure 3-3 Maintenance Menu of Database

3.5 References

(The references listed below are used in this chapter narrative, and are not inclusive of database references).

CEPA. 1997a. *Stress Corrosion Cracking—Recommended Practices*. Canadian Energy Pipeline Association.

CEPA. 1997b. *The CEPA Report on Circumferential Stress Corrosion Cracking. Submitted to the National Energy Board*. Canadian Energy Pipeline Association. December.

CEPA. 1998. *Stress Corrosion Cracking—Recommended Practices. Addendum on circumferential SCC*. Canadian Energy Pipeline Association.

Eiber, R. J., and B.N Leis. 1998. *Protocol to Prioritize Sites for High-pH Stress-Corrosion Cracking on Gas Pipelines*. PRCI. Project PR-3-9403, L51864.

Hall, R.J. and M.C. McMahon. 1999. *Stress Corrosion Cracking Study*. U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety. May.

NACE International. 2003. *External Stress Corrosion Cracking of Underground Pipelines*. Publication 35103. Item Number 24221. October.

NEB. 1996. Stress Corrosion Cracking on Canadian Oil and Gas Pipelines. Report of the Inquiry. National Energy Board. MH-2-95. December.

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